Developing the Decision Making Matrix in Solid Waste Management

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Abstract: *A majority of local governments and urban institutions identified the subject of solid waste environmental problem has reached proportions requiring practical solutions. It can be noted three main trends governing the matter of solid waste:*

- *An increase in the size waste generated from urban housing*
- *Change in the quality of waste generated.*
- *The discharge process of the wastes collected.*

Consequently, these trends play an important role in determining the nature of the solid waste management and decision making process, including its various dimensions and levels. This research include an analytical study for the decision making matrix of Solid Waste Management(SWM) in different dimensions and levels .The dimensions consist of social ,economic ,technological ,political ,and administrative. The levels contain household ,neighborhood, city, and nation. Three cities (Hilla,Najaf,and Kerbala) had been taken as case studies for analyzing these dimensions and levels in decision making of solid waste management. where it is through the use of audit fieldwork and the use of experts in the field of jurisdiction.

After studying the issues in these three cities and operations of waste minimization, waste recycling and waste disposal, so as to indicate defect and gaps in the nature of the decisions and actions existing in the solid waste management of these cities at both the dimensions(social, technological, economic, political, and management), or in terms of levels (family, residential neighbored, city, nation) of these decisions

and actions. After analyzing the results, a matrix for solid waste management had developed by percentages which represent rates of defect in every relationship. Two kinds of conclusions(general and specific) had been stated.

Keywords: Decision making matrix, Solid Waste Management(SWM), Social ,Economic ,Technological ,Political , Administrative Dimensions

1. Introduction and objectives

Municipal solid waste" (MSW) is a term usually applied to a heterogeneous collection of wastes produced in urban areas, the nature of which varies from region to region. The characteristics and quantity of the solid waste generated in a region is not only a function of the living standard and lifestyle of the region's inhabitants, but also of the abundance and type of the region's natural resources. Urban wastes can be subdivided into two major components -- organic and inorganic. In general, the organic components of urban solid waste can be classified into three broad categories: putrescible, fermentable, and non-fermentable. Putrescible wastes tend to decompose rapidly and unless carefully controlled, decompose with the production of objectionable odours and visual unpleasantness. Fermentable wastes tend to decompose rapidly, but without the unpleasant accompaniments of putrefaction. Non-fermentable wastes tend to resist decomposition and, therefore, break down very slowly. A major source of putrescible waste is food preparation and consumption. As such, its nature varies with lifestyle, standard of living, and seasonality of foods. Fermentable wastes are typified by crop and market debris.

The primary difference between wastes generated in developing nations and those generated in industrialized countries is the higher organic content characteristic of the former. (United Nations Environment Programme, 2005).

Solid waste managers in developing countries tend to pay little attention to the topic of reducing non-organic wastes because the wastes they collect are between 50% to 90% organics, dirt and ashes. These municipal wastes, however, are amenable to composting or digestion, provided they contain very low levels of synthetic materials. Solid waste departments thus have an interest in promoting diversion of synthetic recyclables from the waste stream.

Each household generates garbage or waste day in and day out. Items that are no longer needed or do not have any further use for fall in the category of waste and we tend to throw them away. There are different types of solid waste depending on their source. In today's polluted world, learning the correct methods of handling the waste generated has become essential. Segregation is an important method of

municipal solid waste. Segregation at source can be understood clearly by schematic representation. One of the important methods of managing and treating wastes is composting.

As the cities are growing in size and in problems such as the generation of plastic waste, various to try and resolve these problems. One common sight in all cities is the rag picker who plays an important role in the segregation of this waste. Garbage generated in households can be recycled and reused to prevent creation of waste at source and reducing amount of waste thrown into

the community dustbins.

• Key concepts in municipal waste reduction:

Waste reduction: All means of reducing the amounts of waste that must be collected and disposed of by solid waste authorities. It ranges from legislation and agreements at the national level for packaging and product redesign to local programs to prevent recyclables and compostable organics from entering final waste streams.

Source reduction: Any procedure to reduce wastes at the point of generation, in contrast to sorting out recyclable components after they have been mixed together for collection.

Source separation: Keeping different categories of recyclables and organics separate at source, i.e. at the point of generation, to facilitate reuse, recycling, and composting.

Waste recovery, materials recovery, or waste diversion: Obtaining materials/organics (by source separation or sorting out from mixed wastes) that can be reused or recycled.

Reuse: Reusing a product for the same or a different purpose.

Recycling: The process of transforming materials into secondary resources for manufacturing new products is called recycling.

Redemption center: Waste trading enterprise that buys recyclable materials and sells to brokers. Sometimes also called "buy-back centre".

Producer responsibility: Producers of products or services accept a degree of responsibility for the wastes that result from the products/services they market, by reducing materials used in production, making repairable/recyclable goods, and/or reducing packaging.

• **Promoting waste reduction and materials recovery at the national and local levels:**

Action for waste reduction can take place at both national and local levels.

At the national level, the main routes to waste reduction are:

➤redesign of products or packaging;

➤promotion of consumer awareness; and

➤promotion of producer responsibility for post-consumer wastes (this applies mostly to industrialized countries).

At the local level, the main means of reducing waste are:

➤diversion of materials from the waste stream through source separation and trading;

➤recovery of materials from mixed waste;

➤pressure on national or regional governments for legislation on redesigning packaging or products; and

➤support of composting, either centralized or small-scale.(Prakriti, 2006)

A majority of local governments and urban institutions identified the subject of solid waste environmental problem has reached proportions requiring practical solutions. It can be noted three main trends governing the matter of solid waste:

➤An increase in the size waste generated from urban housing

➤Change in the quality of waste generated.

➤The discharge process of the waste collected.

Consequently, these trends play an important role in determining the nature of the solid waste management and decision

making process, including its various dimensions (social, economic, technological, political, and administrative). The development of decision-making matrix to ensure the absorption of these dimensions and different levels of resolution will be one of the objectives of the research, In addition to the application of this matrix in the cities of the case study, namely, (the city of Hilla, Najaf, Karbala) and thus know the nature of the interrelationships of the solid waste management in these cities.

2. The dimensions and levels of decision-making in the management of solid waste:

It may be difficult to choose a general approach to the development of a practical framework for Solid Waste Management (SWM), and that this framework includes social dimensions, economic, technological, political and managerial. For example, the social dimension of solid waste management includes the process of reducing waste (Waste Minimization).The economic dimension of the management of solid waste contains the recycling process of waste (Waste Recycling). The technological dimension of the solid waste management contains disposal of waste process (Waste Disposal). While the political and administrative dimensions include all the above three issues(minimization , recycling and disposal)(Srinivas, Hari ,2006) .

The Figure (1) illustrates the nature of these dimensions.

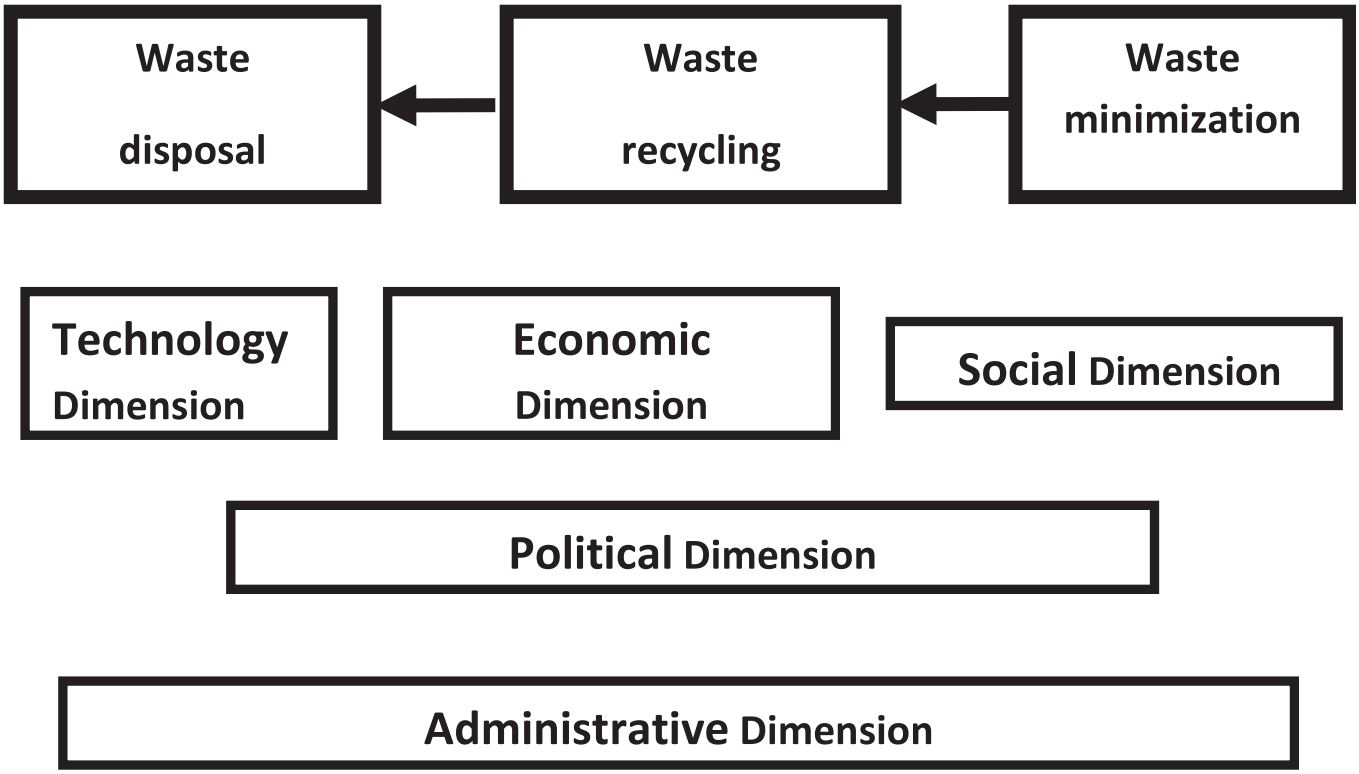

Fig (1) illustrates the social, economic, technological, political and administrative (SWM)

The management of solid waste is not an isolated phenomenon so that it can be easily fragmentation and resolved by technological and engineering creativity, so, it is a complex urban issue related directly and indirectly to number of issues: --

-issue of urban life patterns

- issue of resource consumption patterns
- issue of income levels and business
- social and economic issues
- cultural issues

These issues must be placed together on the plane to be insure long-term solutions to urban waste.

There went a civilized waste management requires that the study is placed in every touch, from (Micro level) the family and residential neighbored to the (Macro - level) the city, state, and nation.

The scientific hypothesis here is that the solid waste management (SWM) must be performed at the city level (City level) .

End – of –Pipe refer to finding solution to a problem at the final stage of its cycle of causes and effects in the case of urban waste . it means focusing on waste disposal rather then waste recycling or waste minimization . Instead of taking a holistic approach to long-term, this approach lacks the comprehensive and gradual solutions to the problem of wastes.

In fact, there are a range of actions required at all levels, family, residential camp, country, and that the procedure to be accomplished can have a nominally social, technological, economic, political, and administrative.

It is necessary, that the decision (action) the right to be taken when performing the right level. In the sense that the action at the household level is essentially social, technological, and economic in nature and the action could be taken at the state or nation level is necessarily economic, political, and administrative in nature. Any action at the levels of residential neighbored and city, contains the five dimensions above(Srinivas, Hari ,2006) .

3. Matrix of dimensions and levels of decision-making:

The matrix connect between the dimensions of the decision-making (social, technological, economic, political, administrative) and decision-making levels (family, residential neighbored, city, nation) to help classification decisions, procedures and related activities, which are to be carried out.

The Fig (2) shows the matrix that links between the dimensions and levels of decision-making in (SWM).

Nation	*City*	*Neighbored*	*House hold*	*Levels / Dimension*
	*	*	*	*Social*
	*	*	*	*Technology*
*	*	*	*	*Economic*
*	*	*		*Political*
*	*	*		*Administrative*

Fig (2) shows the matrix of solid waste management (SWM matrix)

The above matrix has been field tested in the cities of Nepal ,China, Philippine, and Japan. Experts from these countries, had classify activities and different procedures for solid waste management in their cities within the matrix, which helped to identify the defects, shortages, gaps and points of lack of awareness in the decisions policy, programs and projects (Srinivas, Hari ,2006) .

4. The case study: application of the matrix on some cities in Iraq :

For the purposes of application, three cities (Hilla, Najaf and Karbala) has been selected within the Middle Euphrates region of Iraq to its proximity to the researcher's location and the availability of the security side, where it is through the use of audit fieldwork and the use of experts in the field of jurisdiction.

After studying the issues in these three cities and operations of waste minimization, waste recycling and waste disposal, so as to indicate defect and gaps in the nature of the decisions and actions existing in the solid waste management of these cities at both the dimensions(social, technological, economic, political, and management), or in terms of levels (family, residential neighbored, city, nation) of these decisions and actions.

After analyzing the results, a matrix for solid waste management had developed by percentages which represent rates of defect in every relationship.

For example: a 100% defect amounted to the gap and lack of awareness in the decisions and actions, and the percentage of 0% the absence of any defect in the decisions and actions and the gradual descent in the other disorder (Al-Anbari, Mohammad Ali, 2000).

The figure (3) shows the matrix applied to the case study cities.

Nation	*City*	*Neighbored*	*House hold*	*Levels* / *Dimension*
	65%	*70%*	*93%*	***Social***
	52%	*93%*	*35%*	***Technology***
	88%	*88%*	*85%*	***Economic***
68%	*68%*	*67%*		***Political***
68%	*68%*	*67%*		***Administrative***

Fig (3) shows the matrix of (SWM) case study cities

5. Conclusions

• General conclusions:

a - One benefits of (SWM) matrix is to allow simple and easy to understand the suitability of different standards of social, political and cultural attitudes. The gaps in current programs and initiatives for solid waste management can be set and known. The matrix helps to understand the interrelationships and the link between the various issues.

b - There is a gradual shift from remedial solutions (End - of - Pipe Solution)which focuses on the disposal of waste, to theprecautionary approach, which focuses on the source (Source Based Approach) and whose job is to analyze Life - Cycle Analysis. This places the responsibility not only families but also to manufacturers and businesses.

The more awareness at the level of local communities and business have forced manufacturers to take their turn to more environmentally friendly including the quality management of the waste that produced and using a more holistic assessment of the life (More Holistic Life-Cycle).

c- As a result of the above in a, b, the process of compiling and conducting operations on the rest of the waste is not confined to local government, and call now to a comprehensive partnership between the community and local government each of them a role to play towards the reduction of waste, recycling, and disposal of waste.

d - The (SWM) is a process not an isolated municipality problem solved by the local government, but there is need for more comprehensive measures. Thus, within this approach, the integration of solid waste management activities must be part of a larger process of urban environmental management (Urban Environmental Management).

• **Specific conclusions:**

It may be obvious conclusion of the matrix of decision-making in the management of solid waste of the case study cities as follows:

1. That there is a large defect in the process of reducing solid waste, both at the household level, residential neighbored level, or the city level.

2. That there is a large defect in the process of recycling waste at the household level, residential neighbored level, or the city level.

3. That there is defect in the process of disposal of waste at the household level, residential neighbored level, or the city level.

4. Of the points above are found, the existing trend is still focused on the remedial approach in solving the problem which is waste disposal. Either reduce the waste and recycling is still a curriculum is not used effectively.

5. The precautionary approach, such as the prevention or reduction of waste is still an approach is not implemented in the cities of Iraq / Case study, and needs to find legislation and regulations and procedures necessary to make it a realistic approach through the use of the most comprehensive method to assess the life cycle of solid waste (Holistic Life Cycle Assessment of the Solid Waste).

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